Hydrogen Separation Materials

Capabilities/Facilities

Polymer synthesis and characterization laboratories, membrane formation, gas and liquid membrane permeability testing, chemical synthesis and catalysis, and computational modeling.

Materials

Polymer membranes, polymer-ceramic composite membranes, perovskites, zirconia, NASICON and ceria.

Scientific/Engineering Issues

Membrane utility/durability, molecular design, mechanisms of selective mass transport, polymer membrane degradation, defect chemistry and ionic conductivity.

Staff

F.F. Stewart, E.S. Peterson, M.T. Benson, M.K. Harrup, T.P. O'Holleran, and J.-F. Jue.

Recent Projects

- "Energy Saving Separations Technologies for the Petroleum Industry: An Industry-University-National Laboratory Partnership," DOE Office of Energy Efficiency and Renewable Energy, $250K/year
- "Hydrogen Gas Getters," DOE Office of Environmental Management, $200K/year
- "Membrane Separations for Industrial Waste Water," DOE Office of Energy Efficiency and Renewable Energy, $100K/year
- "Thermally Optimized Membranes for Carbon Dioxide Separations," DOE Office of Fossil Energy, $700K/year

Collaborations

- INL/Los Alamos National Laboratory/Pall Corp., "Thermally Optimized Membranes for Carbon Dioxide Separations"
- INL/Colorado School of Mines/BP Aromatics, "Energy Saving Separations Technologies for the Petroleum Industry: An Industry-University-National Laboratory Partnership"
- Manuela Serban and Michele Lewis (Argonne National Laboratory-East), Brenden Boyle (University of Pennsylvania)

Publications

"Energy Saving Separations Technologies for the Petroleum Industry: An Industry-University-National Laboratory Research Partnership,"

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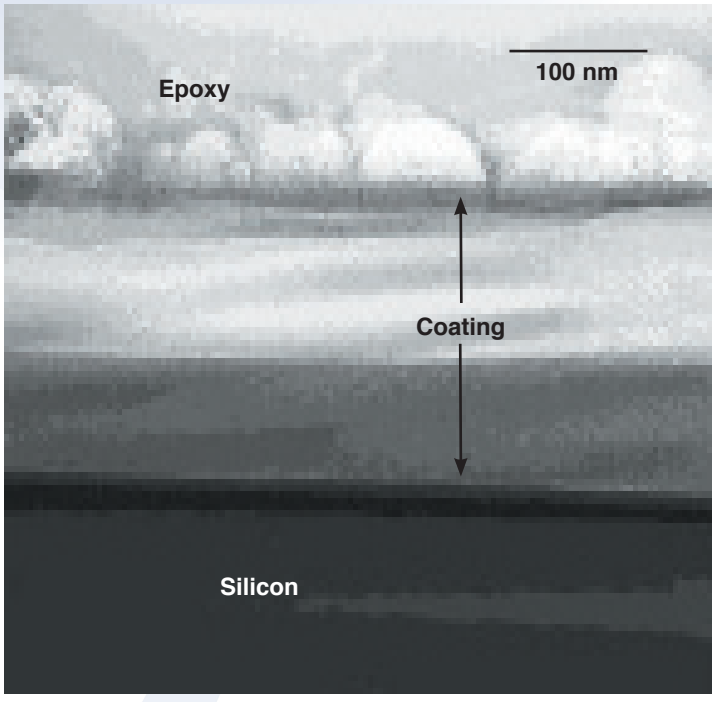

Bright-field TEM micrograph of a multiple coating of nanocrystalline ion-conducting ceramic film on silicon substrate.

Science
INL
Idaho National Laboratory

Continued from front

J.R. Dorgan, F.F. Stewart and J.D. Way, Technical Report DOE/ID-13998-final, March 28, 2003.

"Density Functional Investigation of Melamine-Formaldehyde Crosslinking Agents – Part 1: Partially Substituted Melamine," M.T. Benson, *Industrial & Engineering Chemistry Research*, Vol. 42, p. 4147, 2003.

"Characterization of Gas Transport in Selected Rubbery Amorphous Polyphosphazene Membranes," C.J. Orme, M.K. Harrup, T.A. Luther, R.P. Lash, K.S. Houston, D.H. Weinkauf and F.F. Stewart, *Journal of Membrane Science*, Vol. 186, p. 249, 2001.

"Synthesis of Nanocrystalline NASICON-type Thin Film Ceramics", P.A. Lessing and G. Huestis, Accepted by Journal of Ceramic Processing Research.

"Low Temperature Hydrogen Transport Using a Palladium/Copper Membrane", P.A. Lessing, H.C. Wood, and L.D. Zuck, *Journal of Materials Science,* 38, p. 2401-2408, 2003.

For more information

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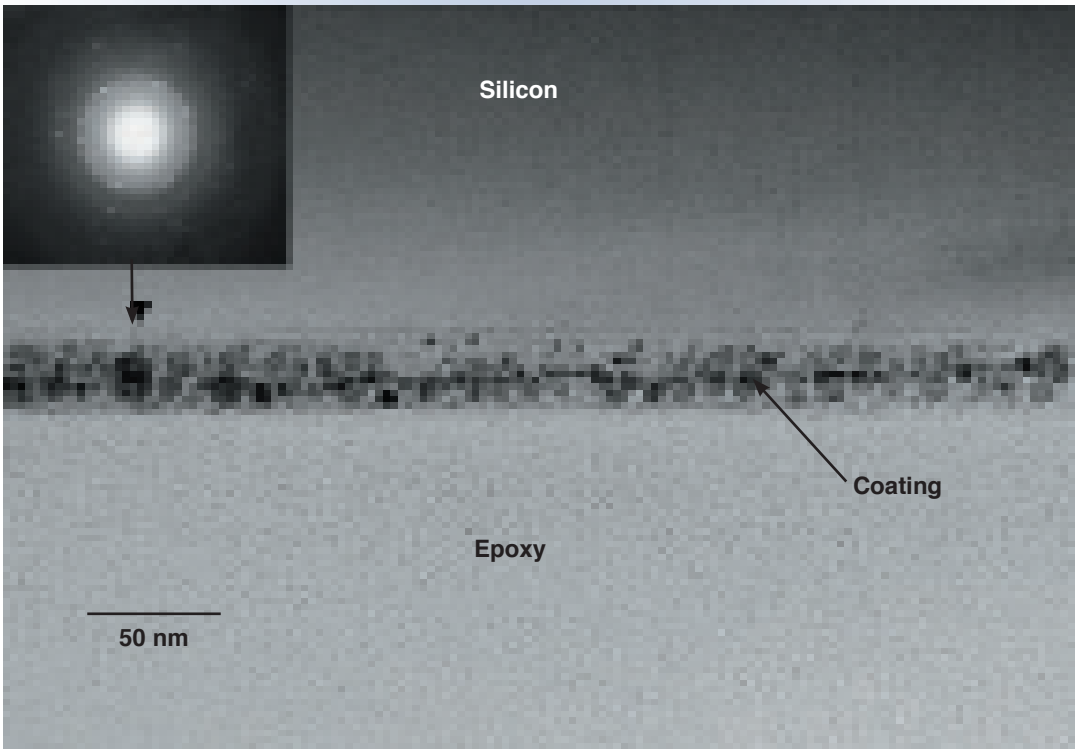
INL is a U.S. Department of Energy national laboratory operated by Battelle Energy Alliance



TEM micrograph of a ceramic thin-film (~80 nm) coating on a silicon substrate. A selected area diffraction ring pattern is shown at the upper left.